

Kinderhook Creek Bioassessment

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Darrow School

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Background

This fall, Ms Williams' Stream Ecology class is studying the Kinderhook Creek. Our study site is located on Pease Road in Stephentown, NY. It is a class C stream because it is a trout-fishing stream. It is a fourth order stream.

When we drove the watershed a few days before going to the study site, we determined that 75% of the watershed land is used and the other 25 is untouched. Approximately 50% of the used land is farmland. These farms include cows, horses, llamas, and crops consisting of cornfields, apple orchards, and hay fields. The other half is residential and commercial. The commercial sites include such places as a metal working shop, a logging site, and a wind turbine. For the most part, the watershed is rural. Along the road there are houses, but where the properties end there is untouched land.

Some potential point source pollutants could be a pipe emptying sewage into the stream or a farmer depositing dung in the stream, but in this assessment we didn't determine that there was any such pollution. At the setting of the stream, there is cropland across the street along with grazed pastures and a llama farm. Past the left bank there was an ungrazed meadow. These three factors were very dominant.

Physical Assessment

Channel Characteristics

The dates we visited the creek were September 28, 2007 at 1:40 pm and October 1, 2007 at 8:25 am. On both days the weather was overcast. The water temperature for each day was 16° Celsius. The air temperature was 18° Celsius on both days as well. The average width of the stream was 5 meters and 70 centimeters. The average depth of the creek was 27 cm. To determine the velocity of the stream we observed how long it took a leaf to go 83.5cm. It took the leaf four seconds, making the velocity 20.875 cm/sec. The relative flow on both days was average to low. The deposits in the sediment were mostly sand and rocks. The water did not smell and it was clear. 25 to 50 percent of the bottom of the stream was covered by algal growth. The stream appeared to be neither straightened nor channelized, but instead, seemed to follow a natural path. There were no dams or

wastewater treatment discharge coming from upstream and there were no pipes emptying into or near the water.

Habitat Characteristics

The composition of the substrate consisted of 70% rubble, 10% gravel, 10% sand, 5% silt, and 5% organic debris. The embeddedness of the stream was 5-25%. The overhead canopy covered 60% of the stream.

Stream bank Characteristics

The left bank, when facing upstream had 50% shrub, 10% grass, and 40% hardwood growth. The right bank, facing upstream, had 75% shrub growth, and 25% hardwood growth. The stream didn't appear to be eroding on either bank.

Chemical Assessment

The class tested different levels of chemicals present in the stream in order to determine the overall health of the stream. We tested for pH and Alkalinity, nitrates, phosphates, temperature and turbidity, dissolved oxygen and fecal coliforms. These tests were conducted on water that was collected from the stream on November 9, 2007.

pH and Alkalinity

The pH level is monitored because if the stream is too acidic or basic it can be bad for the plant life in and around the stream. The NYSDEC standard for a Class C stream should not be less than 6.5 and no more than 8.5 on the pH scale. The LaMotte #2119 kit was used to test the pH of the stream, and our results were 7.05 which correspond with the NYSDEC standards. Alkalinity is the water's defense system against acid. Alkalinity is important to a stream's health because high alkalinity is an indicator that a stream is capable of neutralizing any added acid. The standard range for a healthy stream is anything higher than 35 mg/L. The LaMotte #4491-DR kit was used in order to test for the Alkalinity of the water, and our averaged results were 49 mg/L which means the Kinderhook Creek is not sensitive to a change in calcium carbonate.

Nitrates

The nitrate level of streams is monitored because excess nitrate can be toxic to human and aquatic life. Large amounts of nitrates can cause heavy algae growth and can obstruct waterways and interrupt a stream's ecosystem. The NYSDEC standard for a Class C stream should not be "none in amounts that will result in growths of algae, weeds and slimes that will impair the waters for their best usages." The LaMotte # 3354 kit was used to test the nitrate level and the results were 0 mg/L but since nitrate is a natural occurrence in nature it was concluded the nitrate was present in the water however only in trace amounts; which is a healthy amount of nitrate.

Phosphates

Phosphate is an essential part of a body of water; however in excess it can cause eutrophication which is detrimental to the stream's health. The NYSDEC standard for a Class C stream is "none in amounts that will result in growths of algae, weeds and slimes that will impair the waters for their best usages." The LaMotte # 3121-01 was used to test the phosphate level. Any result over .05 mg/L slightly impacts a creek. The Kinderhook Creek had a phosphate level of 0.1 mg/L, which means that it is slightly impacting the stream.

Temperature and Turbidity

Temperature is important in a stream because it can affect the rate of many processes as well as the amount of oxygen gas that can dissolve in the water. There is no standard for the stream temperature. The temperature of the Kinderhook Creek was 14 degrees Celsius. Turbidity is the amount of suspended particles in the water. An elevated turbidity can affect the raise the temperature because of the particles absorbing the heat disrupting the aquatic life in the water. The NYSDEC standard for turbidity is "no increase that will cause a standard substance visible contrast to natural conditions." The Kinderhook Creek had close to no turbidity.

Dissolved Oxygen

Having a healthy amount of dissolved oxygen (DO) is important for maintaining a functioning ecosystem. A low level of DO is an indication of pollution. The NYSDEC

standard should be no more 7 mg/L and no less than 4 mg/L. Our results were 10 mg/L which means that it is slightly impacting the stream.

Biological Assessment

It is important for us to collect data on benthic macroinvertebrates because we can use the data to determine whether or not a stream is healthy. It also helps to indicate biodiversity in a stream and in the surrounding areas. In order to collect the bugs we used the “kick-net” method. Two people stood about one meter apart, one person holding a net in the water and the other person kicking the silt and the rocks to dislodge bugs from rocks. Occasionally the person would rub two rocks to take clingers off of them. Once we acquired a sample we sorted the leaves and the rocks out, making sure to soak the bugs in ethyl alcohol. We then put the selected bugs in a tray with a grid system in it and randomly chose a square, which we used to identify bugs from.

Benthic Macroinvertebrate Subsample

Order	Family	#	Plecoptera	Leuctridae	2
Coleoptera	Elmidae	4	Plecoptera	Peltoperlidae	2
Diptera	Ceratopogonidae	1	Plecoptera	Perlidae	6
Diptera	Empidadae	2	Plecoptera	Perlodidae	1
Diptera	Ephydriidae	1	Plecoptera	Pteronarcyidae	2
Diptera	Pelecorhychidae	1	Plecoptera	Taeniopterygidae	3
Diptera	Pseudosmittia	1	Trichoptera	Brachycentridae	5
Diptera	Simuliidae	2	Trichoptera	Heliocopsychidae	2
Diptera	Stratiomyidae	1	Trichoptera	Hydropsychidae	5
Diptera	Tipulidae	6	Trichoptera	Hydroptilidae	3
Ephemeroptera	Baetiscidae	3	Trichoptera	Lepidostomatidae	2
Ephemeroptera	Caenidae	1	Trichoptera	Leptoceridae	8
Ephemeroptera	Ephemerellidae	1	Trichoptera	Limnephilidae	4
Ephemeroptera	Heptageniidae	9	Trichoptera	Odontoceridae	1
Ephemeroptera	Leptohyphidae	1	Trichoptera	Philopotamidae	1
Ephemeroptera	Leptophlebiidae	1	Trichoptera	Phryganeidae	2
Ephemeroptera	Tricorythidae	1	Trichoptera	Rhyacophilidae	3
Plecoptera	Capniidae	1	Trichoptera	Sericostomatidae	5
Plecoptera	Chloroperlidae	3	Trichoptera	Uenoidae	1

Major Indices:

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The Organism density of our stream is 244. Organism density measures the amount of organisms in the specific stream. Since our number is high there are a lot of organisms in the Kinderhook creek.

The EPT richness of the Kinderhook Creek is 9 out of 10. This means that the stream is not impacted and very healthy, since anything over a seven is considered healthy. It also means that there are nine species of larvae in the Kinderhook, including Flatheaded mayflies, Spiny Crawler mayflies, Small minnow mayflies, Netspinner caddisflies, Stone case caddisflies, Square wooden case caddisflies, Fingernet caddisflies, Predator stoneflies, and Small shredder stoneflies.

The taxa richness of the stream was 38. Taxa richness measures the amount of species that are found at a site. Ours shows that the stream is very biodiverse and has lots of species. The Biotic index of the stream was 2.31. This shows that the stream is not impacted and very healthy as well.

The Percent Composition shows the amount of pollution tolerant and non-tolerant organisms in the stream. Our numbers show that there is a higher number of non-tolerant BMI's. Since our percent composition contains more non-polluted BMIs it shows that the stream is non-impacted and healthy. The Percent Model Affinity measures the difference between the model community and our own data. The lower the percent model affinity is the more impacted the stream is. Our number is 52, which means the stream is slightly impacted.

E-coli and total coliform

We collected and measured e-coli and total coliform because these coliforms can cause diseases to humans and any animals that live in or around the stream, high levels can affect the surrounding area and surrounding ecosystems. To measure the level of fecal coliform in the Kinderhook Stream we used the membrane filtration method, which measures the number of fecal colonies that grow on a culture medium. The results are measured by the amount of colonies per millimeter per water. The standard for our stream, which is a body contact recreation stream, is: "fewer than 200 colonies/100mL."

The results of our test were 55 colonies/ 100mL, which measures up to the standard set by the NYS DEC. Although the stream was only tested once this still shows that the stream is healthy, very low amounts of fecal coliforms.

Summary of Study Results

Physical parameters

- The Kinderhook Creek is a tributary of the Hudson river, a relatively small stream at our study site, flowing through a residential area.
- It appeared to be a healthy stream, showing little erosion and clear water with no smell.

Chemical parameters

- Dissolved oxygen had a level of 10 mg/L.
- Temperature was 14 degrees Celsius.
- There was close to no turbidity.
- The pH was between the standard range of 6.8 and 7.3 at 7.05.
- The averaged alkalinity was 49 mg/L which indicated a non sensitive stream.
- The phosphate level was over the standard .05 mg/L at 0.1 mg/L which had a slight impact on the stream.
- There were 55 colonies per 100 mL which met the fecal colliform standard for swimming and recreation at fewer than 200 colonies per 100 mL.
- There were only trace amounts of nitrate found.

Biological Parameters

- The Percent Model Affinity was 51.
- The Taxa Richness was 38.
- The Organism Density was 244.
- The EPT Richness was 8.
- The Biotic Index was 2.3.

Conclusion

Our testing of the stream provided us with a clear knowledge of the Kinderhook Creek. Our physical assessment showed that the stream was healthy to our sight and smell. Our biological assessment showed that the stream was only slightly impacted, if not impacted at all. Our chemical assessment showed a very healthy stream that concluded with all of the standards set out by the NYS DEC. According to these three factors, the Kinderhook Creek is a healthy body of water.

Suggestions

If someone were to study the Kinderhook Creek again I suggest that they do more than one day of chemical testing. This might provide more concrete answers and a more solid understanding of the stream. I suggest that Darrow School continues its long term study of the site. The site is currently healthy but that can be easily changed.

Bibliography

Behar, Sharon. Testing the Waters: Chemical & Physical Vital Signs of a River. River Watch Network, 1997.

Mitchell, Mark K., and William B. Stapp. Field Manual for Water Quality Monitoring. 11th ed. Dubusque, IO:Kendall/ Hunt Publishing Company, 1996.

"Total Suspended Solids and Turbidity in Streams." A Citizen's Guide to Understanding and Monitoring Lakes and Streams. 23 May 2007. 8 Nov 2007
<[http://www.ecy.wa.gov/PROGRAMS/WQ/plants/management/joysmanual/strea
mtss.html](http://www.ecy.wa.gov/PROGRAMS/WQ/plants/management/joysmanual/strea
mtss.html)>.